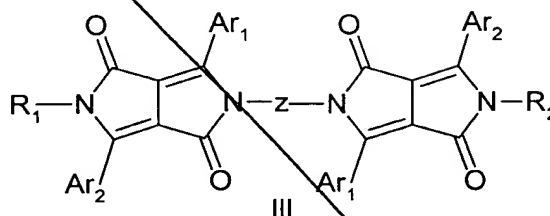
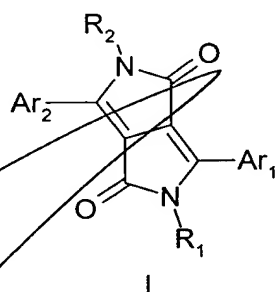


Claims

1. Electroluminescent device comprising in this order

- (a) an anode
- (b) a hole transporting layer
- (c) a light-emitting layer
- (d) optionally an electron transporting layer and
- (e) a cathode

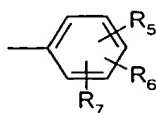
and a light-emitting substance, wherein the light-emitting substance is a diketopyrrolopyrrole ("DPP") represented by formula I or formula III



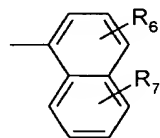
wherein R₁ and R₂, independently from each other, stand for C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₃alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄ independently from each other stand for hydrogen or C₁-C₄alkyl, or phenyl which can be substituted one to three times with C₁-C₃ alkyl,

Ar₃ stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, halogen or phenyl, which can be substituted with C₁-C₈alkyl or C₁-C₈alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4,

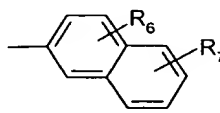
Ar₁ and Ar₂, independently from each other, stand for aryl radicals, preferably for



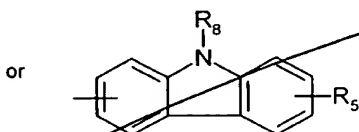
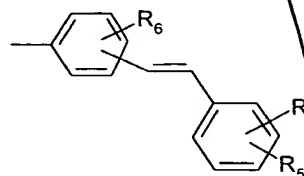
or



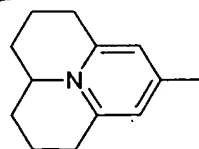
or



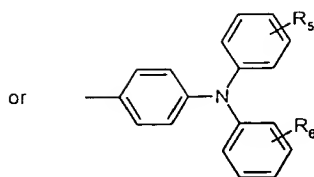
or



or julodidyl,



, which can be substituted one to four times with C₁-C₄alkyl, C₁-C₄alkoxy, or phenyl



wherein

R_5 , R_6 and R_7 , independently from each other, stand for hydrogen, cyano, halogen, C_1 - C_6 alkyl, $-NR_8R_9$, $-OR_{10}$, $-S(O)_nR_8$, $-Se(O)_nR_8$, or phenyl, which can be substituted one to three times with C_1 - C_8 alkyl or C_1 - C_8 alkoxy,

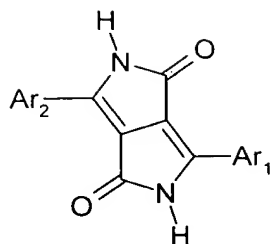
wherein R_8 and R_9 , independently from each other, stand for hydrogen, phenyl, C_1 - C_{25} -alkyl, C_5 - C_{12} -cycloalkyl, $-CR_3R_4-(CH_2)_m-Ph$, R_{10} , wherein R_{10} stands for C_6 - C_{24} -aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C_1 - C_8 alkyl, C_1 - C_8 alkoxy, or halogen, or R_8 and R_9 stand for $-C(O)R_{10}$, wherein R_{11} can be C_1 - C_{25} -alkyl, C_5 - C_{12} -cycloalkyl, R_{10} , $-OR_{12}$ or $-NR_{13}R_{14}$, wherein R_{12} , R_{13} , and R_{14} stand for C_1 - C_{25} -alkyl, C_5 - C_{12} -cycloalkyl, C_6 - C_{24} -aryl,

or

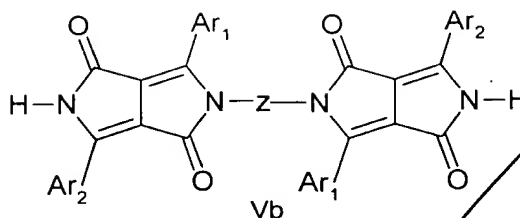
a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein the aryl and heterocyclic radical can be substituted one to three times with C_1 - C_8 alkyl or C_1 - C_8 alkoxy, or $-NR_8R_9$ stands for a five- or sixmembered heterocyclic radical in which R_8 and R_9 together stand for tetramethylene, pentamethylene, $-CH_2-CH_2-O-CH_2-CH_2-$, or $-CH_2-CH_2-NR_5-CH_2-CH_2-$, preferably $-CH_2-CH_2-O-CH_2-CH_2-$, and n stands for 0, 1, 2 or 3, and wherein Z stands for a diradical selected from the group consisting of a single bond, C_2 - C_6 alkylene, which can be substituted one to three times with C_1 - C_4 alkyl, C_1 - C_4 alkoxy, or phenyl, phenylene or naphthylene.

2. Process for the preparation of compounds I or III according to claim 1 in treating in a first step the DPP derivative of formula Va or formula Vb

Sub
Cnd



Va

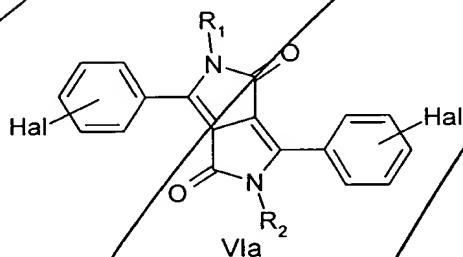


Vb

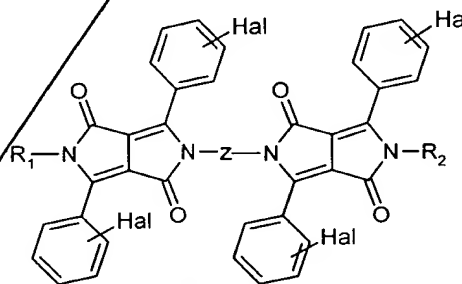
wherein Ar_1 and Ar_2 are defined as in claim 1, with a base, then, in a second step, treating the reaction mixture obtained in the first step with an usual alkylating agent, wherein in the first step the base is a hydride, an alkali metal alkoxide or a carbonate, and the alkylating agent is a sulfonate, tosylate, mesylate, carbonate, sulfate, or halogen compound of the formula $(R_1)_{1 \text{ or } 2}X$, wherein X stands for SO_3^- , (p-Me-phenyl) SO_2^- , (2,4,6-trimethyl-phenyl)- SO_2^- , $-CO_3^-$, $-SO_4^-$, or halogen, or a mixture of $(R_1)_{1 \text{ or } 2}X$ and $(R_2)_{1 \text{ or } 2}X$.

3. Process for the preparation of compounds I or III according to claim 1

(a) in treating in a first step the DPP derivative of formula VIa or formula VIb



VIa



VIb

wherein R_1 and R_2 are defined as in claim 1, Hal stands for halogen, with a nucleophilic agent such as a secondary amine, HNR_8R_9 , a thiol, HSR_8 , or $HS(O)_nR_8$, an alcohol, HOR_{10} , a diselenide, $R_8(O)_nSe-Se(O)_nR_8$, preferably in a molar ratio of DPP VIa or VIb:nucleophilic agent in the range of 1.2:1 to 0.8:1, or, if R_2 has the same meaning as R_1 in the range of from 1:2.5 to 1:1, in the presence of an anhydrous dipolar aprotic solvent, and of an anhydrous base in an amount in the range of from usually 0.1 to 15 moles per mole of the nucleophilic agent, at a temperature in the range of from usually 100 to 220°C and under a pressure generally in the range of from 100 to 300 kPa, and optionally isolating the obtained compound Va, resp. Vb,

(b) then treating the obtained compound Va, resp. Vb (as defined in claim 2), with a base, thereafter in a second step, treating the reaction mixture obtained in the first step of (b) with an usual alkylating agent, wherein in the first step of (b) the base is a hydride, an alkali metal

Sub Cont

alkoxide or a carbonate, and the alkylating agent is a sulfonate, tosylate, mesylate, carbonate, sulfate, or halogen compound of the formula $(R_1)_{1 \text{ or } 2}X$, wherein X stands for SO_3^- , (p-Me-phenyl)- SO_2^- , (2,4,6-trimethyl-phenyl) SO_2^- , $-CO_3^-$, $-SO_4^-$, or halogen, or a mixture of $(R_1)_{1 \text{ or } 2}X$ and $(R_2)_{1 \text{ or } 2}X$.

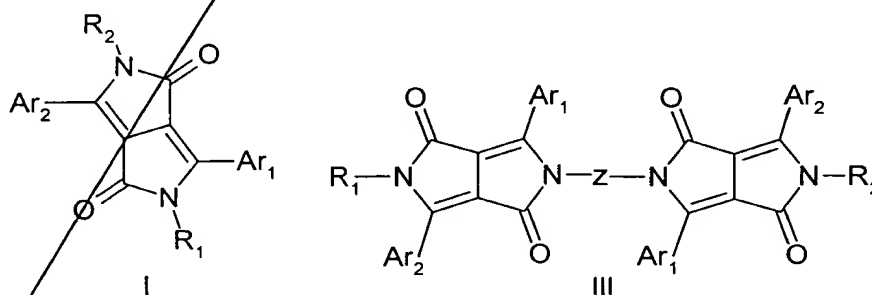
4. Method of coloring high molecular weight organic materials by incorporating the DPP compounds I or III according to claim 1 into said materials in analogy to known methods in the art.

5. Composition comprising

- (a) 0.01 to 50% by weight, based on the total weight of the colored high molecular weight organic material, of a fluorescent DPP I or III according to claim 1, and
- (b) 99.99 to 50% by weight, based on the total weight of the colored high molecular weight organic material, of a high molecular organic material, and
- (c) if desired, customary additives in effective amounts.

6. Composition according to claim 6, wherein the high molecular weight organic material is a polyamide, a polystyrene, preferably high impact polystyrene, polymethylmethacrylate or an ABS copolymer.

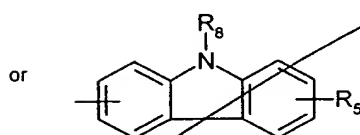
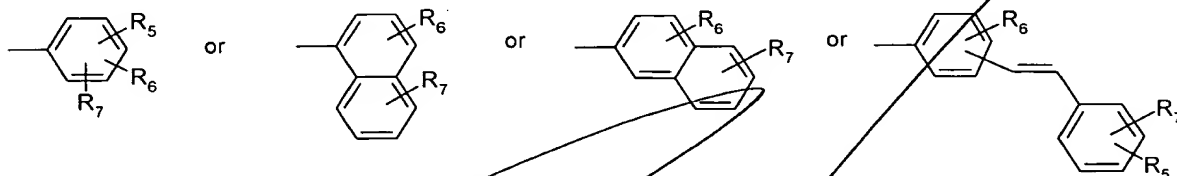
7. Fluorescent diketopyrrolopyrroles represented by formula I or formula III



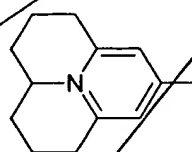
wherein R_1 and R_2 , independently from each other, stand for C_1 - C_{25} -alkyl, allyl which can be substituted one to three times with C_1 - C_3 alkyl or Ar_3 , or $-CR_3R_4-(CH_2)_m-Ar_3$, wherein R_3 and R_4 independently from each other stand for hydrogen or C_1 - C_4 alkyl, or phenyl which can be substituted one to three times with C_1 - C_3 alkyl,

Ar₃ stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, halogen or phenyl, which can be substituted with C₁-C₈alkyl or C₁-C₈alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4,

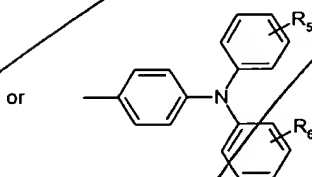
Ar₁ and Ar₂, independently from each other, stand for aryl radicals, preferably for



or julolidyl,



, which can be substituted one to four times with C₁-C₄alkyl, C₁-C₄alkoxy, or phenyl



wherein

R₅, R₆ and R₇, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆alkyl, -NR₈R₉, -OR₁₀, -S(O)_nR₉, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,

wherein R₈ and R₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ stands for C₆-C₂₄-aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms,

wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, or halogen, or

R₈ and R₉ stand for -C(O)R₁₀, wherein R₁₁ can be C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, R₁₀, -OR₁₂ or -NR₁₃R₁₄, wherein R₁₂, R₁₃, and R₁₄ stand for C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, C₆-C₂₄-aryl,

or

a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein the aryl and

heterocyclic radical can be substituted one to three times with C_1-C_8 alkyl or C_1-C_8 alkoxy, or $-NR_8R_9$ stands for a five- or sixmembered heterocyclic radical in which R_8 and R_9 together stand for tetramethylene, pentamethylene, $-CH_2-CH_2-O-CH_2-CH_2-$, or $-CH_2-CH_2-NR_5-CH_2-CH_2-$, preferably $-CH_2-CH_2-O-CH_2-CH_2-$, and n stands for 0, 1, 2 or 3, and wherein Z stands for a diradical selected from the group consisting of a single bond, C_2-C_6 alkylene, which can be substituted one to three times with C_1-C_4 alkyl, C_1-C_4 alkoxy, or phenyl, phenylene or naphthylene, with the proviso that R_6 and R_7 do not stand simultaneously for hydrogen.

Sub B1
Cont

Add
C4

add

Add B3